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Study of short time pulses in the photoelectric effect under conditions of Antarctica (station Novolazarevskaya)

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The study of the short time pulses in the photoconductive and photoemissive effects was carried out in 2005-2009 at station Novolazarevskaya (Antarctica) (IPY Project N 380).

The pulses in the photoconductive effect were independently detected by the photocalorimeter (without the working medium) and by spectrometer AvaSpec-2048. The sudden current changes with amplitude ~10 times exceeding the trivial noisy signals and with duration less than 0.1s were regarded as a pulses. While comparing the photocalorimeter and spectrometer readings it was found that the daily number of pulses detected by photocalorimeter varies from day to day consistently with daily number of fluctuations recorded by spectrometer at frequencies 222 nm and 520 nm. Statistical analysis of data for 2005-2009 showed that the daily number of photocurrent pulses follows the time variation of such characteristics of solar activity, as index F10.7 cm and the total solar irradiance (TSI), but does not correlate at all with the solar cosmic rays. The conclusion is made that the pulses in the internal photoelectric effect are associated with the unknown penetrating agent of the solar origin.

The pulses in the photoemissive effect were detected by the multichannel spectrometer AvaSpec-2048 as energetic deviations in zenith spectra of free daytime atmosphere at frequencies 332 nm, 333.5 nm, 342.5 nm, 351.5 nm and 395.2nm. Analysis of the photoemissive data for polar day periods (September-February) of 2006 2008 showed that the photoemissive effect correlates with the solar cosmic rays flux. It implies that the effect should be related to the photochemical processes in the middle and upper atmosphere. Indeed, behavior of the energetic fluctuations in range 329 nm – 334 nm turned out to be well consistent with the time run of the total ozone content (TOC) above Novolazarevskaya station.

Keywords: solar activity, solar cosmic rays, photoconductive effect, photoemissive effect